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Japan

Japan is the world's fourth largest energy consumer and second largest energy importer (after the United States). Over the past decade, Japan has been experiencing a period of slow economic growth, and has taken important steps towards economic deregulation and restructuring. As a result of slow economic growth, Japanese demand for energy has been stagnant in recent years.

Note: Information contained in this report is the best available as of April 2001 and is subject to change.



RECENT DEVELOPMENTS

Japan's economy began a modest recovery in 1999 from its recession of 1998, which was related to the Asian financial crisis. However, over the last several months, Japan's recovery seems to have stalled. Japan's real gross domestic product (GDP) grew 2.0% in 2000, and is forecast to grow 1.5% in 2001, though there is considerable downside risk in this projection. Unemployment has climbed slightly in recent months to 4.8% from a low point of 4.6% in August 2000.

The Bank of Japan recently cut its short-term lending rate to effectively zero in an attempt to provide monetary stimulus. Many analysts are concerned that, with Japan's government debt having risen sharply in recent years, the large government spending increases which have helped stimulate economic growth in recent years will not be sustainable. Strong export sales by Japanese firms have also helped promote growth, but any economic downturn in Japan's primary export markets in North America and Europe could have a serious negative effect on Japan.

Japan's current Prime Minister, Yoshiro Mori, recently announced publicly his intention to leave office in the near future. A successor has not yet been chosen by the Liberal Democratic Party (LDP), which holds a majority of seats in the Japanese legislature, the Diet.

Japan's economic stagnation since the early 1990's has led to a period of consolidation in its energy sector. Demand has been stable, and its energy industries, particularly the downsteam oil sector, have undergone a period of downsizing and consolidation. Japan remains important to the world energy sector, though, as one of

the main exporters of energy-sector capital equipment, and engineering, construction, and project management services.

ENERGY

Japan lacks significant domestic sources of energy and must import substantial amounts of crude oil, natural gas, and other energy resources, including uranium. In 1999, the country's dependence on imports for primary energy stood at more than 79%. Oil provided Japan with 52% of its total energy needs, coal 15%, nuclear power 15%, natural gas 13%, hydroelectric power 4%, plus 1.3% renewable sources. About half of Japan's energy is used by industry and about one-fourth by transportation, with nearly all the rest used by the residential, agricultural, and service sectors. Japan's energy intensity (energy use per unit of GDP) is among the lowest in the developed world.

OIL

Japan contains almost no oil reserves of its own (59 million barrels of proven oil reserves), but is the world's second largest oil consumer (after the United States). In 2000, Japan consumed an estimated 5.6 million barrels per day (bbl/d) of oil. Most (75%-80%) of this oil came from OPEC, particularly Persian Gulf countries like the United Arab Emirates, Saudi Arabia, Kuwait, Qatar, and Iran. Japan has worked -- with relatively little success -- to diversify its oil import sources away from the Middle East. Another oil supplier to Japan is China, which, while it is a net oil importer, supplies light oil from its Daqing field for use in Japanese power plants. Until 1996, when Japan's oil consumption peaked at nearly 5.9 million bbl/d, Japanese oil consumption (and imports) had been growing steadily for years. After 1997, Japan's consumption declined as its economic slump caused oil demand for industrial and other uses to decline.

Japanese oil companies have been active overseas since 1967, when the government established a state-run company to promote overseas oil exploration, the Japan National Oil Company (JNOC). Over the years, JNOC amassed numerous bad loans through extensive investment programs and loan guarantees to Japanese exploration firms. A study of JNOC for the Japanese Ministry of International Trade and Industry (MITI), conducted by the American consulting firm Booz Allen and Hamilton, concluded that Japan's policy of subsidies for oil exploration left firms with little incentive to seek high rates of return on their investments. JNOC pulled out of more than a dozen projects in 2000, as a result of the review. JNOC also has shifted policy in favor of purchasing stakes in proven oilfields, rather than exploration.

The loss of drilling rights by Japan's Arabian Oil Company (AOC) in the Saudi Arabian portion of the Neutral Zone dealt a major blow to Japan's policy of seeking overseas equity in oil projects. AOC's rights to the concession, which produced 280,000 bbl/d, expired at the end of February 2000. Efforts to negotiate an extension with the Saudi authorities failed when Japan had refused to commit to investment in development projects desired by the Saudis. Saudi Aramco has taken over operation of the former AOC fields. AOC continues to operate its assets in the Kuwaiti portion of the Neutral Zone, for which its concession expires in 2003.

To some extent, Japan has been trying to make up for the loss of the AOC concession in Saudi Arabia by increasing its investment in Iran. Iran announced in November 2000 that it would begin exclusive negotiations with Japan Petroleum Exploration Corporation (Japex) and Indonesia Petroleum (Inpex), both of which are majority-owned by JNOC, for development rights for the huge onshore Azadegan oilfield, which has been estimated to contain 6 billion barrels of recoverable reserves. There are also indications that AOC may join the negotiations at some point. The Azadegan field is expected to reach peak production of around 400,000 bbl/d once fully developed.

Apart from its interests in the Persian Gulf, Japan also has been seeking equity stakes in the Caspian Sea region. In July 1998, Mitsui purchased a 15% share, along with Azerbaijan's State Oil Company, of concessions in the Caspian Sea's Kur Dashi oil field. Oil reserves in the contract area are estimated at 500 million-1 billion barrels. In February 1999, JNOC announced that it would help finance the oil development project, the first since it revealed its major financial difficulties in June 1998. The Kur Dashi oil field is important to Japan's strategic goal of reducing its dependence on Middle Eastern oil imports. In December 1998, four other Japanese companies (Japan Petroleum Exploration Corp., Teikoku Oil Co., Indonesia Petroleum Ltd., and Itochu Corp.) signed a deal to purchase a different field (Atashgyakh-Mugandeniz-Yanan Tava) in the Caspian. JNOC's most significant purchase in 2000 was a 7% stake in Kazakhstan's offshore Kashagan field in the Caspian Sea, through its subsidiary Inpex. The deal reflected JNOC's new empasis on acquiring stakes in proven oilfields.

Refining/Downstream

As of January 2001, Japan had 5.0 million bbl/d of oil refining capacity at 35 refineries. In recent years, as Japan's petroleum product consumption has stagnated, the country's refining industry has suffered from overcapacity. Japan also began to allow imports of petroleum products in the mid-1990s, putting additional pressure on

Japanese refiners to cut costs and become internationally competitive.

In response to these pressures, Japan's refining industry went through a round of consolidations in 1999 and 2000. Nippon Oil and Mitsubishi Oil completed a merger in early 1999, forming Nippon Mitsubishi Oil. Nippon Mitsubishi then acquired Koa Oil from Caltex in September 1999. In October 1999, Nippon Mitsubishi announced a strategic alliance with another independent Japanese refiner, Cosmo Oil. The move, while not a merger, allows the two companies to coordinate distribution of refined products and to reduce costs through reduced duplication of some functions.

A second alliance coalesced around Showa Shell, Royal Dutch Shell's Japanese subsidiary, in which it owns a 50% stake. In January 1999, Showa Shell and Japan Energy announced a strategic alliance in petroleum product distribution and crude oil procurement.

The third major player in Japan's refining sector is ExxonMobil, through its Japanese subsidiary, Tonen General Sekiyu, which resulted from the merger of two ExxonMobil subsidiaries in February 2000. It is the third largest of the alliances in terms of market share.

The only Japanese refiner outside of the major alliances is the privately-held Idemitsu Kosan. This refiner has a limited product sharing arrangement with Nippon Mitsubishi, but its debts make it an unappealing merger-partner.

While many regulatory restrictions on Japanese refiners have been removed over the last few years, the firms remains saddled with a requirement to maintain mandatory large petroleum stocks. This requirement permits Japan to maintain a strategic reserve without having to build a government-run storage facility like the U.S. Strategic Petroleum Reserve, but also imposes significant additional capital costs on refiners operating in Japan.

NATURAL GAS

Japan has about 1.4 trillion cubic feet (Tcf) in proven natural gas reserves, with possibly more under the seabed surrounding Japan. Because domestic natural gas production is minimal, rising demand is being met by greater imports. About 97% of Japan's gas is imported, all in the form of liquefied natural gas (LNG). Most of this LNG comes from Southeast Asia, with 36% from Indonesia and 19% from Malaysia. The United States also supplies a small quantity of LNG to Japan from a facility in Alaska, which accounts for slightly over 2% of Japan's gas consumption. Most of the LNG is used either for electric power generation or as feedstock for petrochemical plants.

Three Japanese gas companies, Tokyo Gas, Osaka Gas, and Toho Gas signed a contract in May 2000 for the import of gas from Malaysia's MLNG Tiga project, covering deliveries over a period of 20 years beginning in 2004. Tokyo Gas, Toho Gas, Tohuku Electric, and Osaka Gas all signed an agreement in late 2000 or early 2001 for LNG purchases from Australia's Nowth West Shelf LNG project, to begin in 2004-2005. In another major development, supplies from ExxonMobil's Arun LNG terminal in the province of Aceh in Indonesia were disrupted in March 2001 due to ongoing political violence. The main Japanese customer of Arun LNG is Tohuku Electric. It is unclear when the Arun LNG plant will resume operation.

Japanese firms have been considering the possibility of imports, either by pipeline or as LNG, from large gas deposits on the Russian island of Sakhalin. ExxonMobil and Shell are backing rival development options - ExxonMobil a pipeline to Japan's main island of Honshu, and Shell an LNG export terminal which would have Japanese firms as its primary customers. Neither project yet has a firm agreement with a buyer, and major logistical obstacles due to the island's harsh climate and remote location remain problematic.

Much of Japan's urban area is not served by a gas distribution system. With plans to increase the natural gas portion of its primary energy supply to 13% by 2010, however, Japan is considering expansion of its internal gas pipeline system. Many analysts cite the absence of an effective gas distribution system as a key reason for Japan's high retail energy prices.

City gas consumption has increased by more than 70% in the last decade due to a 25% increase in natural gas customers and also to a large rise in consumption by industry. Japan's major gas companies include Tokyo Gas, Osaka Gas and Chubu gas. The Japanese government has indicated that it plans to deregulate the retail gas sector in over the next several years to promote increased competition and lower prices.

COAL

Japan has small coal reserves of only 865 million short tons (Mmst) and minimal coal production. Japan is by far

the world's largest importer of steam coal, mainly for power generation, paper plants, and cement production. Japan also is the world's largest importer of coking coal for its steel industry. Overall, Japan accounts for about 22% of total world coal imports. Sources of imported steam coal are Australia, South Africa, the United States, and China. Japanese coking coal imports come mainly from Australia, Canada, the United States and Russia.

Japan maintains heavily subsidized domestic coal production, partly for energy security reasons and partly in order to support the development of coal technology. Coal production has declined under competitive pressure from imported coal -- from about 61 Mmst in the early 1960s to about 4 Mmst in 1999. In March 1997, Japan's largest and oldest coal mine, the Miike coal mine on the main island of Kyushu, was closed after 124 years of operation. This leaves only two coal mines open in Japan -- in Kushiro on Japan's northern island of Hokkaido, and in Sotome in Nagasaki Prefecture on Kyushu. The two mines produce around 4 Mmst of coal annually, and both are heavily subsidized (domestic coal is priced three times higher than imported coal).

In March 1999, Japanese coal firm Idemitsu agreed to participate in a coal development project in China's Shandong Province. Idemitsu hopes to secure coal supplies and in exchange, China will gain technical consulting from the Japanese firm. Idemitsu will evaluate coal quality, analyze combustion and test compatibility with boilers used in Japan. Prior to fiscal 2000, Idemitsu will help China to select coal deposits for mining, evaluate its quality and then set a target quality for exports to Japan. Production will begin at 2.1 Mmst annually and will eventually be sold to Japanese electric power companies. Japan and Vietnam signed an agreement for cooperation on coal technology in November 2000.

ELECTRICITY

Japan generated 1,018 billion kilowatthours (Bkwh) of electricity on 226 gigawatts of capacity in 1999. Of Japan's total generation, about 59% came from thermal (oil, gas, and coal) plants, 30% from nuclear reactors, 8% from hydroelectric dams, and less than 3% from geothermal, solar, and wind. Japan's electric generation is expected to increase to 1,280 Bkwh by 2020. Due to the country's desire to enhance its energy security, Japan has developed a large nuclear power industry. Despite its relatively high cost, gas, mainly imported as LNG, also is likely to experience considerable growth as a fuel for electricity generation. Renewables, chiefly hydropower and geothermal energy, also are expected to grow, and both coal and nuclear are projected to grow in absolute terms (although nuclear power's share of the market is expected to drop). An accelerating decline is projected for oil-fired generation, which is still more significant in Japan than in most other OECD countries. In the short-term, Japan's economic slowdown had resulted in a slowdown in capital spending by utilities, which has delayed several new power plant projects.

Japan's electricity prices are currently the highest in the OECD, and Japan has begun a program of reforms designed to make its electric utility sector more efficient. Currently, Japan is served by 10 vertically integrated utilities which each have a specific geographic zone. The Japanese Diet passed a bill in May 1999 which amended the Electric Utilities Industry Law (EUIL) to allow a partial opening to competition. Beginning in March 2000, about 8,000 large industrial and commercial Japanese electric power consumers comprising roughly one-third of the Japanese power market have been able to chose their electricity suppliers. Regional utilities currently are obligated to allow power from other suppliers to transit their grids to these large consumers.

While a small percentage of Japan's electricity has been provided by independent power producers (IPPs) since 1995, the new deregulation is expected to generate much more investor interest in developing IPPs. Already, Enron has announced that it plans to invest as much as \$900 million in the purchase of underutilized cogeneration units at industrial sites, supplying power back to those users and selling the rest to smaller commercial consumers such as hospitals and hotels.

Nuclear Power

Japan's nuclear output nearly doubled between 1985 and 1996, as Japan attempted to move away from dependence on oil following the 1973 Arab oil embargo. During the past few years, public opposition to Japan's nuclear power program has increased in reaction to a series of accidents at Japanese nuclear plants, most recently the accident at the Tokaimura uranium processing plant in September 1999. Other problems for Japan's nuclear power program have included rising costs of nuclear reactors and fuel, the huge investments necessary for fuel enrichment and reprocessing plants, several reactor failures, and the question of nuclear waste disposal. By raising its reliance on nuclear-generated electricity, Japan is hoping to reduce its carbon dioxide emissions. In August 1998, the Atomic Energy Commission approved the construction of a new light-water reactor, which will be built in Higashidori in Aomori prefecture in northern Japan. Also, in March 1999, the Japanese Nuclear Safety Commission approved plans for Hokuriku Electric Power Co. to build a new nuclear power plant in the central town of Shika, which will be on line by 2006. By 2008, nine new reactors are expected to be operating, providing an additional 11.3 gigawatts (GW) in capacity.

Currently Japan ranks third worldwide in installed nuclear capacity, behind the United States and France. In 1999, Japan had 51 units in operation with an installed capacity of 45 GW, providing 309 Bkwh of electricity -- equivalent to a nuclear share of 30%.

To enhance its energy security, the government advocates uranium and plutonium recovery through reprocessing of spent fuel. The Power Reactor and Nuclear Fuel Development Corporation (PNC) operates a reprocessing plant with an annual capacity of 90 tons but a larger reprocessing plant, Rokkasho-Mura, with a capacity of 800 tons per year, planned for completion in 2005, is under construction. Reprocessing is expensive and costs can quickly rise with new safety requirements and the development of new technologies. Estimated in 1993 to cost about \$8 billion, a more recent estimate for Rokkasho-Mura places the total at \$15 billion. In the meantime, Japan is negotiating with the French firm COGEMA for the reprocessing of spent nuclear fuel in France. COGEMA may also continue to reprocess some spent fuel even after the Rokkasho plant is completed. Japan also is interested in recycling recovered plutonium. In 1999, Japan began -- in two prefectures -- a controversial mixed-oxide utilization plan, which involves burning a highly toxic mix of plutonium and uranium on a commercial scale.

ENVIRONMENT

In recent years Japan has begun to take a more active role in protecting the <u>environment</u>. As <u>air pollution</u> in dense urban areas has persisted, the Japanese government has taken a number of measures to mitigate it, such as encouraging the adoption of low-polluting mass transportation buses and garbage collection vehicles as alternatives to diesel.

The effects of the oil shocks in the 1970s forced Japan to streamline heavy industrial production and reorient its economy toward less <u>energy intensive</u> industries. As a result, while Japanese <u>energy consumption</u> is high, Japan is a world leader in terms of energy efficiency, and a newly revised energy savings law is aiming to reduce the <u>per capita energy consumption</u> in Japan even further.

Japan committed to reducing its total <u>carbon emissions</u> by 6% under the 1997 Kyoto Protocol, but as Japan is the world's fourth largest producer of greenhouse gases, the task ahead is difficult. Japan's economy is heavily dependent on imported oil, but the government is placing increased emphasis on the diversification of its energy sources. In addition to nuclear power Japan is looking to increase its share of solar, hydro, and other carbon-free, non-polluting <u>renewable</u> energy sources. In the <u>21st century</u> Japan will need to continue in its role as a leading developer of environmental technologies in order to protect its environment.

COUNTRY OVERVIEW

Chief of State: Emperor Akihito (since 1/7/89)
Prime Minister: Yoshiro Mori (since 4/5/00)

Population (2000E): 126.5 million

Location/Size: Eastern Asia - island chain between the North Pacific Ocean and the Sea of Japan/145,882

square miles (slightly smaller than California)

Major Cities: Tokyo (capital), Osaka (Kansai), Nagoya, Fukuoka/Kitakyushu, Sapporo

Languages: Japanese

Ethnic Groups: Japanese (99.4%)

Religion: Shinto and Buddhist (84%), other (16%)

Defense (8/98): Army (151,800), Navy (43,800), Air Force (45,600), U.S. Forces in Japan (39,100)

ECONOMIC OVERVIEW

Currency: Yen

Exchange Rate (4/6/01): US\$1 =124.3 Yen

Gross Domestic Product (GDP) (2000E): \$4.8 trillion Real GDP Growth Rate (2000E): 2.0% (2001E): 1.5%

Inflation Rate (consumer prices)(2000E): -0.7% (2001E): -0.4%

Current Account Balance (2001E): \$93.4 billion

Major Trading Partners: United States, Germany, Asian NIEs, China, OPEC

Merchandise Exports (2001E): \$456.8 billion Merchandise Imports (2001E): \$333.7 billion Merchandise Trade Surplus (2001E): \$123.3 billion

Major Export Products: Machinery and transport equipment; chemical and other manufactured goods

Major Import Products: Chemical and other manufactured goods; machinery and transport equipment; mineral

fuels; foodstuffs; crude material

ENERGY OVERVIEW

Proven Oil Reserves (1/1/01E): 59 million barrels

Oil Production (First 3 months/2001E): 76,620 barrels per day (bbl/d), of which 7,000 bbl/d is crude oil

Oil Consumption (2001E): 5.6 million bbl/d Net Oil Imports (2001E): 5.5 million bbl/d

Crude Oil Refining Capacity (1/1/01E): 5.0 million bbl/d

Major Crude Oil Import Sources (2001E): United Arab Emirates, Saudi Arabia, Kuwait, Iran, Qatar, Indonesia

Natural Gas Reserves (1/1/01E): 1.4 trillion cubic feet (Tcf)

Natural Gas Production (1999E): 0.08 Tcf Net Natural Gas Consumption (1999E): 2.64 Tcf

Natural Gas Imports (1999E): 2.58 Tcf

Coal Reserves (12/31/96E): 865 million short tons (Mmst) Coal Production (1999E): 4.1 million short tons (Mmst)

Coal Consumption (1999E): 149.5 Mmst Net Coal Imports (1999E): 145.4 Mmst

Electric Generation Capacity (1/1/99E): 226 gigawatts
Electricity Production (1999E): 1,018 billion kilowatthours

ENVIRONMENTAL OVERVIEW

Minister of Agriculture, Forestry, & Fisheries: Tokuichiro Tamazawa

Director General Environment Agency: Kayoko Shimizu

Total Energy Consumption (1999E): 21.7 quadrillion Btu* (5.7% of world total energy consumption)

Energy-Related Carbon Emissions (1999E): 306.6 million metric tons of carbon (4.9% of world total carbon emissions)

Per Capita Energy Consumption (1999E): 171.6 million Btu (vs U.S. value of 355.8 million Btu)

Per Capita Carbon Emissions (1999E): 2.4 metric tons of carbon (vs U.S. value of 5.5 metric tons of carbon)

Energy Intensity (1999E): 6,523 Btu/\$1990 (vs U.S. value of 12,638 Btu/\$1990)**

Carbon Intensity (1999E): 0.09 metric tons of carbon/thousand \$1990 (vs U.S. value of 0.19 metric tons/thousand \$1990)**

Sectoral Share of Energy Consumption (1998E): Industrial (50.5%), Transportation (19.3%), Residential (15.8%), Commercial (14.4%)

Sectoral Share of Carbon Emissions (1998E): Industrial (50.1%), Transportation (25.1%), Residential (13.2%), Commercial (11.6%)

Fuel Share of Energy Consumption (1999E): Oil (52.1%), Coal (15.3%), Natural Gas (12.7%)

Fuel Share of Carbon Emissions (1999E): Oil (60.4%), Coal (26.6%), Natural Gas (13.0%)

Renewable Energy Consumption (1998E): 1,342 trillion Btu* (1% increase from 1997)

Number of People per Motor Vehicle (1998): 1.8 (vs U.S. value of 1.3)

Status in Climate Change Negotiations: Annex I country under the United Nations Framework Convention on Climate Change (ratified May 28th, 1993). Under the negotiated Kyoto Protocol (signed on April 28th, 1998, but not yet ratified), Japan has agreed to reduce greenhouse gases 6% below 1990 levels by the 2008-2012 commitment period.

Major Environmental Issues: Air pollution from power plant emissions results in acid rain; acidification of lakes and reservoirs degrading water quality and threatening aquatic life; Japan is one of the largest consumers of fish and tropical timber, contributing to the depletion of these resources in Asia and elsewhere.

Major International Environmental Agreements: A party to the Antarctic-Environmental Protocol, Antarctic Treaty, Biodiversity, Climate Change, Desertication, Endangered Species, Environmental Modification, Hazardous Wastes, Law of the Sea, Marine Dumping, Nuclear Test Ban, Ozone Layer Protection, Ship Pollution, Tropical Timber 83. Tropical Timber 94. Wetlands and Whaling.

ENERGY INDUSTRIES

Organizations: Electric Power Development Co. (EPDC) - a quasi-governmental wholesale power company established in 1952 to help secure stable supplies of electricity. EPDC is scheduled for privatization within the next 5 years. Power Reactor and Nuclear Fuel Development Corp. (PNC, or Donen) -- the government nuclear oversight organization; Japan National Oil Company -- government owned

Major Oil Companies: Arabian Oil (Tokyo), Cosmo Oil, Tonen General Sekiyu, Indonesia Petroleum Ltd., Itochu, Japan Energy, Japan National Oil Corp. (JNOC), Japan Petroleum Exploration., Mitsui Oil Exploration, Nippon

^{*} The total energy consumption statistic includes petroleum, dry natural gas, coal, net hydro, nuclear, geothermal, solar, wind, wood and waste electric power. The renewable energy consumption statistic is based on International Energy Agency (IEA) data and includes hydropower, solar, wind, tide, geothermal, solid biomass and animal products, biomass gas and liquids, industrial and municipal wastes. Sectoral shares of energy consumption and carbon emissions are also based on IEA data.

^{**}GDP based on EIA International Energy Annual 1999

Mitsubishi Oil, Showa Shell Sekiyu, Sodeco, Sumitomo, Teikoku Oil

Major Electric Power Companies: Chubu Electric, Chugoku Electric, Hokkaido Electric, Hokuriku Electric, Japan Atomic Power, Kansai Electric, Kyushu Electric, PNC, Shikoku Electric, Tohoku Electric, Tokyo Electric Major Refineries (capacity, bbl/d): Negishi (365,750), Ichihara -- Chiba (228,000), Mizushima (190,000), Cosmo

-- Chiba (228,000), Showa Yokkaichi (222,000), Tonen Kawasaki (292,950)

Pipelines: Crude oil 52 miles; petroleum products 200 miles; natural gas 1,116 miles

Sources for this report include: Coal Week International; Dow Jones News wire service; Economist Intelligence Unit ViewsWire; Electric Utility Week International; Kyodo News Service; Nikkei Shimbun; Oil and Gas Journal; Petroleum Economist; Petroleum Intelligence Weekly; U.S. Energy Information Administration; WEFA Asia Economic Outlook; World Gas Intelligence.

Links

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